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Genetic Effects of Host Species and Food Quantity of the Mountain Pine Beetle

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Genetic Effects of Host Species and Food Quantity on the Mountain Pine Beetle

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Between 16 June and 8 September 1981, approximately 3000 MPBs were received from Ogden for genetic analysis (Table 1). Major contrasting variables represented by subsamples of these beetles included:

1) female vs. male beetles.

2) separate trees of the same host species and phloem thickness.

3) lodgepole pine (LPP) vs. ponderosa pine (PP) (host species).

4) thick vs. thin phloem (food quantity).

5) endemic, epidemic, and post-epidemic population phases.

6) geographic location (11 sites from the Canadian border to S. Utah).

7) early and late emerging beetles from single trees.

8) second-year samples from 4 sites.

The following is a summary of results of preliminary analysis of these samples.

Electrophoresis. Assays developed and used by us in previous work with MPBs were employed here. Of the 17 gene loci examined, 7 (AAT1, AcP, CK, EST1, LAP2, PEP, and PGI) were polymorphic in some or all samples and 10 (AGP1, AGP2, AGP3, EST2, EST3, IDH, LAP2, MDH1, MDH2, and TO) were monomorphic in all samples. Detection of a rare CK allele in 4 samples put this locus in the polymorphic category (i.e., frequency of the common allele less than or equal to .99); in earlier studies it was considered monomorphic. Nevertheless, for analyses described below, CK was not considered because of its relatively low levels of polymorphism. Four additional unreported allelic forms were also seen at AAT1 (1), AcP (2), and PGI (1). Genotype frequencies for all subsamples and samples are shown in Tables 2a-5a; corresponding allele frequencies are shown in Tables 2b-5b.

Within-site variation. The most detailed series of samples was obtained from Flaming Gorge in NE Utah. Subsamples of the 725 beetles from this site represented individual trees, females vs. males, and beetles from thin- and thick-phloem LPP and PP. Analyses clearly indicate that random mating does not occur among beetles from different host tree species within a stand. When genetic data from all Flaming Gorge beetles was pooled (Table 5a, 3rd column), deviation from random-mating expectations was seen at 5 of the 6 polymorphic loci (AAT1, EST1, LAP2, PEP, and PGI, but not AcP). This deviation was most marked at EST1, LAP2, and PEP. Similar but less marked deviations from random-mating expectations were apparent at AAT1 and LAP2 in pooled beetles from McCall (Table 5a, column 8). At the loci noted, there was a consistent deficiency of heterozygotes and a larger than expected proportion of homozygotes. This observation confirms that, as one would expect, we have pooled subsamples of genetically different beetles. In genetic jargon, this is called the Wahlund effect.

At some loci, differences in gene frequencies were seen between beetles from LPP and PP but these differences were not consistent from site to site (Flaming Gorge to McCall). When beetles from Flaming Gorge were divided according to host tree (LPP and PP, Table 5a, columns 1 and 2), significant ($p < .01$) differences were seen between beetles at AcP and LAP2. Beetles from LPP and PP at McCall (Table 5a, columns 6 and 7) were significantly different at EST1 ($p < .01$) and, again, LAP2 ($p < .05$) but the differences at LAP2 were not of the same type at both sites.

Deviations from random-mating proportions were less marked in samples from the two tree species (compared with the pooled samples), suggesting that at least some of the intra-site variation is attributable to host tree effects. Nevertheless, smaller but still noticable deficiencies of hetero-

zygotes and excess homozygotes did occur at LAP2, PEP, and EST1 at one or both sites.

It therefore appears that the differences observed between beetles in LPP and PP at a single site result indirectly from non-random assortment of genes among beetles from the different tree species and not from any simple, direct selective effect of the trees on any of the particular gene loci examined. These data also suggest that additional variables, such as food quantity (phloem thickness), may also have a significant effect on the genetic makeup of beetles within trees of the same species.

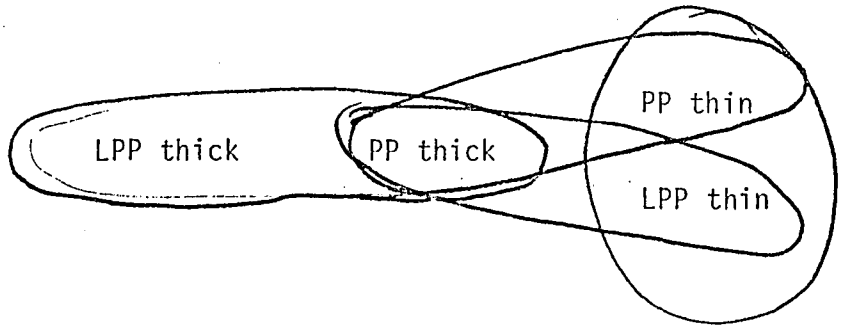
Some significant differences in genetic makeup occur between females and males from individual trees. Comparison of beetles from individual trees (see chi-square values in Table 2b) revealed no differences between females and males at AAT1, two differences at AcP (both between beetles from PP), one difference at EST1 (also PP) and 5 differences at LAP2 (4 LPP, 1 PP). Over all Flaming Gorge subsamples, males showed greater variation than females at AAT1 and EST1, while females showed greater variation from sample to sample at LAP2. At none of these loci was a consistent pattern of genetic difference identifiable in preliminary analysis. However, the data do suggest that female and male MPBs respond differently to the same environmental stresses, a phenomenon noted earlier by Amman in terms of sex ratios and in other MPB genetic studies.

Some differences not apparently related to sex differences occur between beetles from different trees of the same host species and phloem thickness. While no differences occurred among beetles from individual trees of the same species and phloem thickness at AAT1, AcP, PEP, and PGI, beetles from different PP trees (both thick and thin phloem) were more variable at EST1 than beetles from LPP. At LAP2, the converse was true. Higher levels of variation occurred among beetles from different LPP trees, especially those from thin-

phloem LPP.

It is interesting and perhaps significant that genetic variation at LAP2 seems to reveal different characteristics of a population than any of the other polymorphic loci, particularly EST1. Above it is shown that female in general and all LPP beetles are more different at LAP2 while males in general and all PP beetles are more different at EST1. This could suggest that beetles in the different host species are being affected differently by some selective agent which also affects the sexes differently.

Significant differences in genetic makeup occurred between beetles in thick- and thin-phloem trees within and between host species (Table 4a, columns 5, 10, 14, 17; Table 6). Within hosts, species, MPBs from thick and thin phloem LPP were significantly different at LAP2. MPBs from thick and thin phloem trees of both LPP and PP were different at PEP. Beetles in thick phloem LPP were most different from beetles in PP (both thick and thin phloem). A schematic diagram of these general relationships might look something like this:



Preliminary analyses have been initiated for beetles representing populations in different density phases (Tables 7a and b) but no definitive conclusions can yet be drawn.

The largest differences in overall genetic composition among beetles from the different geographic locations were between those from Yaak and Escalante (Figure 1). It is interesting that the two endemic populations

(Hoop Lake and Sawtooth) fall very close together as do the two post-epidemic populations (Targhee and Teton).

Remaining analysis of data on the above comparisons plus morphological comparisons and genetic characteristics of early and late emerging beetles and on second-year samples from NE Utah are in progress.

Table 1. Recorded emergence times for MPBs sent from Ogden, summer 1981.

	JUNE	JULY	AUGUST	SEPTEMBER
	15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1 2 3 4 5 6 7 8 9 10
Flaming Gorge 1	---------- 4 - 9 ---- 25 -32 ---------- 83 ------ 27 ---- 29 --- 7 --- 4 3 9 ------ 25 32 ---------- 83 ------ 27----- 29 --- 7 --- 6 3 ---------- 22			
2	---------- 10 -- 18 -------- 67 ------ 12 29 52 -- 34 --- 5 4 -------- 10 -- 28 -------- 67 ------ 12 - 29 52 -- 34 --- 5 4 ---------- 116			
3	---------- 15 -- 27 13 26 ---- 34 -- 33 -------- 55 ------- 2 ------ 15 -- 27 13 26 ------ 34 -- 33 -------- 55 ------- 2			
4	---------- 20 ----- 5 22 42 ------ 63 ------ 12 37 35 --- 9 ------ 20 ------- 5 22 32 ------ 63 ------ 12 - 27 35 --- 9			
5	---------- 3 - 9 24 ------ 13 ---------- 10 - 3 --- 4 --- 3 4 --------- 3 9 24 ------ 13 ---------- 10 - 3 --- 4 --- 3 4 ---------- 9			
6	---------- 10 -- 21 13 25 ---- 38 -- 38 -------- 45 ---------- 10 -- 21 13 25 ------ 38 -- 38 -------- 45 ------ 14			
7	---------- 19 ---- 30 -- 52 50 ----- 35 ------ 14 2 6 -------- 2 119 ------ 30 -- 52 50 ----- 35 ------- 3 -- 2 - 6 --------- 2 1			
8	---------- 7 ------- 6 13 ---- 37 21 ---------- 36 ------- 3 --- 5 - 7 ------- 6 113 ------ 37 21 ---------- 36 ---------- 5 ---------- 4 1			
21	---------- 38 -- 71 29 78 ---- 14 ---- 18 ---------- 38 -- 71 29 78 ------ 14 ---- 18 ---------- 8 ---------- 3			
24	---------- 7 ------- 6 19 ---- 19 ---- 13 ------ 37 - 3 --- 8 24 13 11 7 19 --- 6 5 19 ----- 29 ---- 13 ------ 37 - 3 ----- 24 13 11 - 19 -- 10 5 ---------- 2			
25	---------- 2 ---------- 1 ---------- 2 ---------- 5 ---- 1			
26	---------- 2 ---------- 10 ----- 7 ----- 5 ------- 3 ---------- 1 2 2 2 --- 1 10 ------- 7 ----- 5 ------- 3 --------- ---- 1 ----- 2 --- 1			
29	---------- 2 ------- 3 ------- 5 --- 4 3 --------- 5 1 ---------- 2 ------- 3 ---------- 4 3 --------- 1 1			
30	---------- 13 - 7 ---------- 9 ----- 4 ---------- 1 ------- 2 13 7 --------- 1 --------- 9 ----- 4 ---------- 1 -------- 2 1 ---------- 1			
Bear River (40)	---------- 17 ---- 20 ---------- 43 ------ 22 -- 89 ---------- 17 ---- 20 ---------- 43 ------- 22 89 ---------- 75			
Sawtooth (50)	-30 25 -- 68 70 32 24 ---------- 30 25 -- 68 70 35 24			
McCall LPP (60)	-26 ---------- 5 ---------- 11 ----- 8 ---------- 11 26 ---------- 5 ---------- 11 ----- 8 ---------- 11			
McCall PP (70)	---------- 10 ---------- 6 ---------- 10 ---------- 6			
Dan Canyon (80)	---- 76 -- 79 -- 110 ---------- 76 -- 79 -- 110 ---------- 71			
Yaak (90)	---------- 38 27 -- 47 ---- 64 ---- 40 ---- 21 ------ 15 ---------- 38 27 -- 47 ---- 64 ------ 50 ---- 27 ------ 15			
Targhee (100)	---------- 18 ----- 6 ------- 2 ---------- 40 1 8 --- 8 -- 14 ---------- 18 ----- 6 ------- 2 13 ------- 40 3 8 --- 8 -- 14 ---------- 4			
Dubois (110)	---------- 16 -------- 41 -- 22 32 --------- 13 ---------- 24 -------- 16 ---------- 41 -- 22 32 ---------- 24			
Teton (120)	---------- 38 19 42 ---- 13 ---------- 38 19 42 ------ 13 ---------- 12			
Escalante (130)	---------- 2 ----- 2 ----- 8 ------ 12 ---------- 22 -------- 38 5 2 ------- 2 ----- 8 ------ 48 90 ---------- 26 -------- 38 5 ---------- 14			
Hood Lake (140)	---------- 29 ---- 24 ---- 74 ------ 48 90 ---------- 29 ------ 24 ---- 74			

Table 2a. Genotype frequencies/females vs. males/individual trees from Flaming Gorge site.

		LPP (thick phloem)										LPP (thin phloem)										PP (thick phloem)								PP (thin phloem)					
		1		2		3		4		pooled		5		6		7		8		pooled		26		29		30		pooled		21		24		pooled	
Enzyme		♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂
AAT1	1-1	27	19	17	16	23	16	17	20	86	71	6	3	19	9	7	7	9	6	32	25	11	2	9	2	9	12	29	16	2	11	5	3	7	14
	1-2	27	13	21	22	21	23	22	21	91	79	10	4	14	10	10	8	7	6	41	28	12	3	8	1	18	8	28	12	6	4	6	5	12	9
	2-2	6	5	8	6	9	7	10	8	36	26	4	0	3	8	3	3	4	3	14	14	1	1	4	0	6	2	11	3	0	3	2	4	2	7
	[2-3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	60	37	46	44	53	46	49	49	213	176	20	7	27	27	20	18	20	15	87	67	24	6	21	3	33	22	78	31	8	13	13	12	21	30
	x^2	.1	1.2	.3	.1	1.2	.1	.3	.4	2.0	.3	0	.1	.3	1.8	0	.1	1.3	.3	0	1.3	.6	0	.8	0	.3	.1	.1	.1	1.7	1.3	0	.2	.9	4.0*
AcP	0-0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0-1	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	2	-	-	-	2
	0-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-1	27	23	17	16	23	24	20	16	88	79	12	1	10	17	8	11	9	4	39	33	13	1	11	2	15	8	39	11	10	9	6	7	16	16
	1-2	30	15	28	24	27	14	25	12	110	65	3	3	11	7	10	6	7	3	31	19	11	4	8	1	12	11	35	16	9	9	5	6	14	14
	2-2	6	6	3	4	4	7	9	10	22	26	2	1	3	6	1	2	1	3	7	12	0	2	2	0	2	1	4	3	0	8	2	2	2	10
	[1-3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	-	-	-	-	-	-	-
	N	63	44	48	44	54	45	54	37	220	170	17	5	24	30	19	19	17	10	77	64	24	7	21	3	32	20	77	30	19	27	13	15	[illegible]	
	x^2	.3	1.7	3.7	1.4	1.1	3.4	.1	[illegible]*	2.1	4.1*	1.4	0	0	6.3*	.4	.3	0	1.1	.1	7.1	.8	.1	.1	0	0	.6	.5	.7	.7	3.[illegible]	.2	.1	.[illegible]	3.
CK	1-1	66	24	40	22	28	40	27	42	161	128	8	6	31	28	20	9	20	14	79	57	2	2	8	2	23	11	33	15	21	30	13	19	34	49
	[1-2]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	66	24	40	22	28	40	27	42	161	128	8	6	31	28	20	9	20	14	79	57	2	2	8	2	23	11	33	15	21	30	13	19	34	49
EST1	1-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]
	1-2	0	0	2	0	2	0	0	0	4	0	0	0	1	0	0	0	1	0	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	1
	1-3	1	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0
	1-4	1	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1
	1-5	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
	1-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2-2	10	9	3	12	10	7	9	7	32	35	2	1	9	2	4	6	7	0	22	9	4	2	6	1	3	4	13	7	3	2	6	6	9	8
	2-3	13	7	7	7	6	[illegible]	11	13	37	36	2	2	6	7	3	4	1	1	12	14	3	1	1	0	8	2	12	3	5	8	4	6	9	14
	2-4	9	6	2	4	[illegible]	11	5	[illegible]	23	24	2	1	3	3	2	2	2	4	9	10	2	0	1	0	3	1	6	1	2	0	2	1	4	1
	2-5	16	5	11	14	11	6	15	[illegible]	53	33	2	1	5	3	3	2	6	5	16	11	6	2	6	1	6	2	18	5	3	7	5	4	8	11
	2-6	0	0	0	0	0	1	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
	3-3	4	5	4	6	4	3	2	4	14	18	2	1	1	0	1	2	0	1	4	2	1	0	0	0	7	0	7	0	3	5	2	2	5	7
	3-4	1	1	3	2	2	1	[illegible]	6	8	10	1	1	1	4	1	0	0	0	3	5	0	0	2	0	3	1	5	1	1	0	2	0	3	0
	3-5	4	7	6	4	5	4	5	7	20	22	4	1	4	3	2	1	2	4	12	7	2	0	1	0	1	1	4	1	7	4	2	4	9	8
	3-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4-4	3	0	4	0	1	2	2	0	10	2	0	0	0	0	1	0	0	0	1	0	1	0	1	0	1	2	3	2	0	0	0	0	0	0
	4-5	1	9	2	0	1	1	2	2	6	12	2	0	1	3	1	1	1	2	5	6	1	0	0	0	1	1	3	2	[illegible]	3	2	0	2	3
	4-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	0
	5-5	1	0	3	1	2	3	3	1	9	5	2	0	1	2	2	2	0	1	5	5	2	1	1	0	1	5	4	6	0	0	5	3	5	3
	5-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	1
	6-6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	N	64	49	47	51	52	50	58	52	218	202	19	7	31	30	20	20	20	19	90	76	24	7	20	3	35	22	78	32	30	30	28	28	58	58
	x^2	7.6	15.9*	4.8	6.4	2.[illegible]	5.8	1.8	4.[illegible]	22.6*	5.8	.5	0	.3	1.6	.5	1.3	0	.8	4.2	1.[illegible]	0	0	.6	0	5.6	2.8	8.[illegible]	4.2	1.7	2.5	1.7	1.4	2.1	.6
LAP2	1-1	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	5	1	-	-	0	-	0	-	0	-	1	0	0	0	1	0
	1-2	0	2	1	0	1	3	2	0	4	5	0	0	3	1	0	2	2	0	5	3	-	-	2	-	1	-	3	-	2	1	0	0	2	1
	1-3	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1	2	2	-	-	0	-	0	-	0	-	0	0	0	0	0	0
	2-2	[illegible]	7	32	10	21	5	29	15	110	37	2	4	6	10	8	5	12	8	[illegible]	27	-	-	3	-	2	-	5	-	12	7	7	11	19	18
	2-3	9	4	7	0	8	2	9	3	33	9	7	2	3	12	3	8	6	8	19	30	-	-	3	-	5	-	8	-	10	11	[illegible]	9	17	20
	3-3	2	0	0	0	2	0	3	0	7	0	4	1	1	5	1	4	0	2	6	12	-	-	0	-	0	-	0	-	3	4	9	1	12	5
	N	39	13	40	10	32	10	43	18	154	51	14	7	19	29	12	20	20	19	65	75	-	-	8	-	8	-	16	-	28	23	29	21	52	49
	x^2	.4	.4	0	0	.3	.1	.7	0	4.5	.3	.2	.1	2.7	.2	.3	.1	.3	0	[illegible]	1.0	-	-	.2	-	1.6	-	2.0	-	0	0	[illegible]	.1	3.[illegible]	0
PEP	1-1	59	46	50	49	54	43	55	49	218	187	19	6	22	28	20	17	19	16	80	67	23	6	20	1	32	21	75	28	29	30	30	30	59	60
	1-2	5	4	0	1	2	1	3	1	10	7	1	1	1	1	0	2	0	3	2	7	1	0	1	2	3	2	5	4	0	0	0	0	0	0
	2-2	0	0	0	[illegible]	0	0	1	0	1	1	0	0	0	1	0	1	1	1	1	3	0	1	0	0	0	0	0	1	1	0	0	0	1	0
	N	64	50	50	50	56	44	59	50	229	195	20	7	23	30	20	20	20	20	83	77	24	7	21	3	35	23	80	33	30	30	30	30	60	60
	x^2	0	0	0	0	0	0	.5	0	.9	.1	0	0	0	0	0	.7	0	.6	.5	1.[illegible]	0	.1	0	0	0	0	0	.1	0	0	0	0	0	0
PGI	[0-1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-1	63	50	49	50	55	46	59	50	226	196	20	7	31	30	19	20	20	20	90	77	24	7	21	3	35	23	80	33	30	30	30	30	60	60
	1-2	1	0	1	0	1	2	1	0	4	2	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2-2	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	N	64	50	50	50	56	49	60	50	230	199	20	7	31	30	20	20	20	20	93	77	24	7	21	3	35	23	80	33	30	30	30	30	60	60
AAP1	N	64	50	50	50	56	50	59	50	229	200	20	7	33	28	20	18	20	20	93	83	24	7	21	3	35	18	80	28	14	30	13	19	27	48
AAP2	N	64	50	50	50	56	50	59	50	229	200	20	7	33	28	20	18	20	20	93	83	24	7	21	3	35	18	80	28	14	30	13	19	27	48
AAP3	N	64	50	50	50	56	50	59	50	229	200	20	7	33	28	20	18	20	20	93	83	24	7	21	3	35	18	80	28	14	30	13	19	27	48
EST2	N	64	50	50	49	56	50	59	50	229	199	19	7	31	30	20	20	20	19	90	76	23	7	20	3	34	22	77	32	30	30	23	29	53	59
EST3	N	64	50	50	49	56	50	59	50	229	199	19	7	31	30	20	20	20	19	90	76	23	7	20	3	34	22	77	32	30	30	23	29	53	59
IDH	N	64	50	50	22	56	49	60	50	230	136	20	7	33	30	20	20	20	20	93	77	24	7	21	3	31	19	76	29	19	30	13	19	32	49
LAP1	N	23	14	40	10	33	10	43	18	155	52	14	7	19	29	20	20	20	19	65	75	0	0	8	0	8	0	16	9	23	30	23	21	51	60
MDH1	N	64	50	50	50	56	44	60	50	230	194	20	7	31	30	20	20	20	20	91	77	24	7	21	3	35	19	79	29	22	30	13	17	35	47
MDH2	N	64	50	50	50	56	44	60	50	230	194	20	7	31	30	20	20	20	20	91	77	24	7	21	3	35	19	79	29	22	30	13	17	35	47
	N	64	50	50	50	56	44	60	50	217	194	20	7	33	28	20	18	20	20	93	73	24	7	21	3	35	18	79	28	14	30	13	19	27	49

Table 2b. A frequencies/females vs. males/from individual trees at Flaming Gorge s

		LPP (thick phloem)										LPP (thin phloem)										PP (thick phloem)										PP (thin phloem)									
		1		2		3		4		pooled		5		6		7		8		pooled		26		29		30		pooled		21		24		nooled									
Enzyme		♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂
4AT1	p(1)	.63	.69	.61	.61	.63	.66	.57	.62	.62	.63	.55	.29	.63	.52	.60	.61	.63	.60	.60	.58	.71	.58	.62	.83	.55	.73	.62	.71	.63	.72	.62	.46	.62	.62								
	p(2)	.32	.31	.39	.39	.37	.34	.43	.38	.38	.37	.45	.71	.37	.48	.40	.39	.37	.40	.40	.42	.29	.42	.38	.17	.45	.27	.38	.29	.38	.28	.38	.54	.38	.38								
	p(3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	N	60	37	48	44	53	46	49	49	213	176	20	7	27	27	20	18	20	15	87	67	24	6	21	3	33	22	78	31	8	18	13	12	21	30								
	x^2	0		0		.2		.5		.1		1.2		1.4		0		0		.1		.7		1.0		3.7		1.7		.5		1.2		0									
AcP	p(0)	-	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.02	-	.01	-	-	.04	-	-	-	.02								
	p(1)	.67	.69	.65	.63	.68	.69	.60	.56	.65	.66	.79	.50	.65	.68	.68	.74	.74	.55	.71	.66	.17	.43	.71	.83	.70	.68	.73	.63	.76	.52	.65	.67	.72	.57								
	p(2)	.33	.31	.35	.36	.32	.31	.40	.44	.35	.34	.21	.50	.35	.32	.32	.26	.26	.45	.29	.34	.23	.57	.29	.17	.25	.33	.25	.37	.24	.44	.35	.33	.28	.40								
	p(3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.03	-	.01	-	-	-	-	-	-	-								
	N	63	44	48	45	54	45	54	39	220	170	17	5	24	30	19	19	17	10	77	64	24	7	21	3	32	20	77	30	19	27	13	15	32	42								
	x^2	.2		1.1		0		.3		1.5		5.9		1.0		.7		2.5		1.1		6.0*		.4		2.4		3.7		6.2*		0		4.3									
CK	p(1)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0								
	p(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-								
	N	66	24	40	22	28	40	27	42	161	128	8	6	31	28	20	9	20	14	79	57	2	2	8	2	23	11	33	15	21	30	13	17	34	47								
	x^2	0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0									
EST1	p(1)	.02	0	.02	.01	.02	.01	0	.01	.01	.01	0	0	0	.03	0	0	.03	.03	.01	.02	.02	.07	.03	0	0	0	.01	.02	0	.03	0	0	0	.02								
	p(2)	.45	.37	.39	.48	.45	.42	.42	.37	.42	.41	.26	.43	.52	.30	.40	.50	.60	.26	.46	.36	.41	.57	.50	.50	.33	.30	.40	.38	.28	.33	.41	.41	.34	.37								
	p(3)	.21	.26	.26	.25	.20	.21	.20	.34	.22	.26	.29	.29	.21	.25	.20	.23	.08	.18	.19	.23	.15	.07	.13	0	.37	.09	.24	.08	.32	.37	.21	.25	.27	.31								
	p(4)	.14	.16	.16	.06	.13	.18	.12	.11	.13	.13	.13	.14	.08	.17	.15	.08	.23	.18	.11	.14	.11	0	.13	.17	.14	.20	.13	.16	.12	.05	.07	.05	.09	.05								
	p(5)	.18	.21	.27	.21	.20	.17	.26	.17	.21	.19	.32	.14	.19	.22	.25	.20	0	.34	.24	.24	.30	.29	.23	.33	.14	.39	.21	.36	.23	.22	.30	.29	.27	.25								
	p(6)	0	0	0	0	0	.01	0	.01	0	0	0	0	0	.03	0	0		0	0	.01	0	0	0	0	.01	.02	.01	.02	.05	0	0	0	.03	0								
	N	64	49	47	51	52	50	58	52	218	202	19	7	31	30	20	20	20	19	90	76	23	7	20	3	35	22	78	32	30	30	28	23	58	58								
	x^2	3.5		10.0		2.8		8.6		5.6		2.1		9.8		1.7		9.6		7.3		3.4		1.2		15.7**		11.0		7.1		.3		7.0									
LAP2	p(1)	0	.03	.01	0	.02	.15	.02	0	.01	.05	.04	0	.37	.05	0	.08	.05	.03	.13	.05	-	-	.13	-	.06	-	.09	-	.07	.02	0	0	.04	.01								
	p(2)	.83	.77	.99	1.0	.80	.75	.39	.92	.83	.86	.39	.71	.47	.57	.79	.50	.80	.63	.62	.58	-	-	.69	-	.63	-	.66	-	.64	.57	.46	.74	.56	.65								
	p(3)	.17	.15	.09	0	.19	.10	.17	.08	.15	.09	.57	.29	.16	.38	.21	.43	.15	.34	.25	.37	-	-	.19	-	.31	-	.25	-	.29	.41	.54	.26	.40	.34								
	N	39	13	40	10	32	10	43	18	154	51	14	7	19	29	12	20	20	19	65	75	-	-	8	-	8	-	16	-	28	23	24	21	52	44								
	x^2	6.1*		2.2		6.5*		2.7		6.9*		7.7*		17.3**		5.9		4.0		9.0*										2.7		7.2*		2.5									
PEP	p(1)	.96	.96	1.0	.99	.98	.99	.96	.99	.97	.98	.98	.93	.98	.95	1.0	.90	.95	.88	.98	.92	.98	.86	.98	.67	.96	.96	.97	.91	.97	1.0	1.0	1.0	.98	1.0								
	p(2)	.04	.04	0	.01	.02	.01	.04	.01	.03	.02	.02	.07	.02	.05	0	.10	.05	.12	.02	.08	.02	.14	.02	.33	.04	.04	.03	.09	.03	0	0	0	.02	0								
	N	64	50	50	50	56	44	59	50	229	195	20	7	23	30	20	20	20	20	83	77	24	7	21	3	35	23	80	33	30	30	30	30	60	60								
	x^2	0		0		0						0																															
PGI	p(0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-								
	p(1)	.99	1.0	.99	1.0	.99	.98	.99	1.0	.99	.99	1.0	1.0	1.0	1.0	.98	1.0	1.0	1.0	.99	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0								
	p(2)	.01	0	.01	0	.01	.02	.01	0	.01	.01	0	0	0	0	.02	0	0	0	.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
	N	61	50	50	50	56	49	60	50	230	199	20	7	33	30	20	20	20	20	93	77	24	7	21	3	35	23	80	33	30	30	30	30	60	60								
	x^2	0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		0									
AGP1		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0								
AGP2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"								
AGP3		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"								
EST2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"								

Table 3a. Genotype frequencies/females vs. males/ by site and host tree species.

		Flamino Corpe LPP		PP		Bear R. LPP		Sawtooth LPP		McCall LPP		PP		Logan C. LPP		Yaak LPP		Targhee LPP		Dubois LPP		Teton LPP		Escalante PP		Hoop Lake LPP	
Enzyme		♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂
AAT1	1-1	118	96	36	30	17	18	5	4	13	4	6	0	10	7	15	3	14	16	13	17	11	12	22	21	9	19
	1-2	132	107	52	22	21	22	8	3	13	6	1	3	10	6	23	11	16	21	19	12	16	23	31	14	10	13
	2-2	60	50	13	10	4	4	6	3	2	7	2	2	3	2	13	4	8	5	4	6	5	8	8	4	4	5
	[2-3]	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	190	253	101	62	43	44	19	10	28	17	9	5	23	15	51	18	38	42	27	35	32	43	61	39	23	37
	x^2					.5	.6	.5	1.1	.2	.8	2.3	0	0	.1	.5	.9	.7	.2	.4	2.0	.1	.3	.3	.5	.2	1.2
AcP	0-0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
	0-1	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-1	127	96	55	28	20	17	19	15	18	11	2	1	18	15	33	9	18	13	21	20	34	19	26	17	22	8
	1-2	141	107	46	30	13	3	18	14	17	3	7	4	14	10	20	7	13	12	20	14	13	9	18	15	14	16
	2-2	29	40	7	13	4	3	5	5	4	2	1	0	6	3	15	5	7	14	4	4	5	2	3	4	3	10
	[1-3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	297	243	117	63	46	23	42	34	39	16	10	5	38	28	68	21	38	39	39	38	52	30	47	35	39	34
	x^2					1.4	2.9	.1	.3	0	1.3	1.2	0	1.3	.3	9.1**	2.0	2.4	6.3*	.3	.4	1.5	.2	0	.1	.1	.1
CK	1-1	240	185	113	106	50	50	26	35	39	17	11	5	40	42	72	23	50	50	33	43	56	44	62	33	50	40
	[1-2]	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	N	240	185	113	106	50	50	27	35	40	17	11	5	40	42	72	24	50	50	33	43	56	44	62	33	50	40
EST1	1-1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0
	1-2	5	1	1	2	0	2	0	1	0	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	0	1
	1-3	1	2	0	1	0	1	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0
	1-4	1	2	0	2	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	2	0	0	2	0
	1-5	0	1	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	2	0	0	1	1	0	1	0
	1-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2-2	54	44	31	17	7	3	4	7	10	1	2	2	4	5	17	5	6	7	5	6	4	2	0	0	9	14
	2-3	49	50	21	28	8	10	5	6	3	5	0	0	8	12	13	11	11	10	11	8	14	10	0	1	9	14
	2-4	32	34	13	11	3	1	5	6	7	2	3	0	3	2	5	4	3	4	2	1	0	0	1	0	0	2
	2-5	69	44	24	22	10	14	3	0	3	1	2	0	10	3	7	7	2	4	8	10	12	8	1	1	13	7
	2-6	0	2	1	0	0	0	0	0	0	1	0	0	0	1	9	1	2	0	0	0	0	0	0	0	0	0
	3-3	18	22	9	11	1	2	6	8	3	2	0	0	3	7	0	2	7	5	7	5	4	1	0	0	1	5
	3-4	11	15	6	5	0	2	5	3	4	2	0	0	2	2	9	2	2	4	2	1	0	1	3	4	0	0
	3-5	32	30	21	16	4	9	6	4	4	0	0	3	13	5	3	7	6	7	5	9	12	8	4	2	4	3
	3-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4-4	11	2	1	0	0	0	2	0	2	0	1	0	0	0	0	2	1	0	0	0	1	0	13	13	0	0
	4-5	11	18	3	10	9	5	4	1	0	0	0	0	5	3	2	1	0	0	6	3	5	8	19	12	0	2
	4-6	0	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
	5-5	14	10	10	8	2	0	1	1	0	0	3	0	1	8	1	3	4	7	3	1	1	2	6	2	5	2
	5-6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
	6-6	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	N	308	278	148	134	44	50	43	38	39	17	11	5	50	50	68	45	46	50	52	45	55	44	50	39	47	50
	x^2					10.1	8.7	1.5	5.4	4.1	.2	.5	0	6.5	11.1	4.9	1.6	2.3	7.0	3.3	2.6	5.3	10.2	.2	.6	4.6	1.1
LAP2	1-1	5	1	6	1	0	1	2	3	0	0	0	0	0	0	1	0	1	2	1	0	0	0	0	0	0	0
	1-2	9	8	7	4	2	0	8	4	3	2	2	1	1	1	1	7	1	0	3	7	6	3	6	1	2	1
	1-3	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2	0	1	1	0	0
	2-2	141	64	50	45	10	7	21	10	15	6	4	0	11	21	20	14	14	15	15	8	25	10	14	7	16	20
	2-3	52	39	36	50	10	10	7	14	7	6	0	1	17	18	21	10	11	17	13	12	16	17	16	22	15	19
	3-3	13	12	18	17	12	9	3	7	8	2	0	0	11	8	15	6	4	10	8	12	5	7	7	6	7	10
	N	222	126	119	119	34	27	41	38	33	16	6	2	40	48	58	37	31	46	40	40	54	37	44	37	40	50
	x^2					4.5	1.4	.6	4.5	8.0	0	0	0	.6	1.4	3.5	5.2	.2	4.9	2.5	8.0*	1.1	.1	1.6	2.3	1.1	1.8
PEP	1-1	298	254	139	127	42	42	41	40	31	17	11	5	50	43	61	42	50	49	47	46	56	42	51	32	39	44
	1-2	12	14	2	7	2	8	4	0	1	0	0	0	0	3	3	2	0	0	4	1	0	1	1	0	3	6
	2-2	2	4	2	3	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1	0	0	1	0	0	0	0
	N	312	272	143	137	44	50	45	40	32	17	11	5	50	46	64	46	50	50	52	47	56	44	52	32	50	50
	x^2					0	.1	.1	0	0	0	0	0	0	0	3.5	5.2*	0	0	.6	0	0	0	0	0	11.1**	0
PGI	[0-1]	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-1	317	273	151	137	50	50	45	39	37	17	11	4	49	50	66	38	50	47	43	47	56	44	61	38	50	50
	1-2	5	2	1	0	0	0	0	0	3	0	0	1	0	0	3	3	0	3	0	0	0	0	1	1	0	0
	2-2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	N	322	276	152	137	50	50	45	40	40	17	11	5	50	50	69	46	50	50	43	47	56	44	62	39	50	50
AGP1	N	313	283	107	77	40	50	30	31	30	17	11	5	40	32	63	30	44	50	30	36	54	44	52	39	41	31
AGP2	N	313	283	107	77	40	50	30	31	30	17	11	5	40	32	63	30	44	50	30	36	54	44	52	39	41	31
AGP3	N	313	283	107	77	40	50	30	31	30	17	11	5	40	32	63	30	44	50	30	36	54	44	52	39	41	31
EST2	N	319	275	135	90	44	50	43	38	39	17	11	5	50	50	72	45	46	50	52	45	55	44	50	39	47	50
EST3	N	319	275	135	90	44	50	43	38	39	17	11	5	50	50	72	45	46	50	52	45	55	44	50	39	47	50
IDH	N	323	213	103	70	50	50	34	40	40	17	11	5	40	42	72	36	50	50	41	47	56	44	62	39	50	40
LAP1	N	220	127	67	44	31	27	41	38	33	16	6	2	40	48	70	36	31	46	52	40	54	37	44	37	40	50
MDH1	N	307	271	111	76	50	50	43	39	40	17	10	5	40	42	72	40	50	50	43	47	56	44	62	39	50	40
MDH2	N	307	271	114	76	50	50	40	39	40	17	8	5	40	42	72	40	50	50	43	47	56	44	62	39	50	40
10	N	310	267	106	77	40	50	30	31	30	17	11	5	40	32	64	16	44	50	30	36	54	44	52	39	41	31

Table 3b. Allele frequencies/females vs. males/ by site and host tree species.

		Flaming Gorge				Bear R.		Sawtooth		McCall				Logan C.		Yaak		Targhee		Dubois		Teton		Escalante		Hoop L.	
		LPP		PP		LPP		LPP		LPP		PP		LPP		LPP		LPP		LPP		LPP		PP		LPP	
Enzyme		♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂
AAT1	p(1)	.61	.61	.61	.66	.64	.66	.47	.55	.70	.41	.72	.30	.66	.67	.52	.47	.58	.63	.67	.66	.59	.55	.61	.72	.61	.69
	p(2)	.39	.39	.39	.34	.35	.34	.53	.45	.30	.59	.28	.70	.34	.33	.48	.53	.42	.37	.33	.34	.41	.45	.39	.28	.39	.31
	p(3)	-	-	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	243	243	101	62	43	44	19	10	28	17	9	5	23	15	51	18	38	42	27	35	32	43	61	39	23	37
	X^2																										
AcP	p(0)	-	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	.03	-	-	-	-	-	-	-	-	-
	p(1)	.66	.62	.72	.60	.72	.80	.67	.65	.63	.78	.55	.60	.66	.71	.63	.60	.63	.49	.74	.71	.78	.78	.74	.68	.74	.47
	p(2)	.34	.38	.28	.39	.28	.20	.33	.35	.32	.22	.45	.40	.34	.29	.37	.40	.34	.51	.26	.29	.22	.22	.26	.32	.26	.53
	p(3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	297	243	109	63	36	23	42	34	39	16	10	5	38	28	68	21	9	39	39	38	52	30	47	36	39	34
	X^2																										
CK	p(1)	1.0	1.0	1.0	1.0	1.0	1.0	.99	1.0	.99	1.0	1.0	1.0	1.0	1.0	1.0	.99	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	p(2)	-	-	-	-	-	-	.01	-	.01	-	-	-	-	-	-	.01	-	-	-	-	-	-	-	-	-	-
	N	240	185	113	106	50	50	27	35	40	17	11	5	40	42	72	24	50	50	33	43	56	44	62	33	50	50
	X^2																										
EST1	p(1)	.01	.01	0	.02	0	.03	.01	.03	.03	.09	0	0	.01	.03	.01	0	.02	.02	.03	.01	.02	.05	.01	.01	.09	.01
	p(2)	.43	.39	.41	.36	.40	.33	.24	.36	.42	.35	.41	.40	.29	.29	.51	.37	.34	.32	.31	.36	.32	.26	.02	.04	.43	.52
	p(3)	.21	.25	.22	.27	.16	.26	.33	.38	.23	.35	0	.30	.29	.33	.18	.27	.37	.32	.31	.31	.31	.24	.07	.09	.17	.27
	p(4)	.13	.13	.10	.10	.14	.09	.22	.14	.22	.15	.23	0	.10	.07	.12	.12	.08	.08	.10	.06	.07	.13	.51	.54	.02	.04
	p(5)	.23	.20	.25	.24	.31	.28	.19	.09	.09	.03	.36	.30	.31	.27	.11	.23	.17	.26	.26	.27	.28	.33	.37	.28	.30	.16
	p(6)	0	.01	.01	.01	0	.01	.01	0	.01	.03	0	0	0	.01	.07	.01	.02	0	0	0	0	0	.02	.04	0	0
	N	308	278	148	134	44	50	43	38	39	17	11	5	50	50	68	45	46	50	52	45	55	44	50	39	47	50
	X^2																										
LAP2	p(1)	.05	.05	.09	.03	.03	.04	.15	.13	.05	.06	.17	.25	.01	.01	.03	.09	.05	.07	.06	.10	.07	.04	.08	.03	.03	.01
	p(2)	.77	.69	.60	.61	.47	.44	.70	.50	.61	.63	.83	.50	.50	.64	.53	.61	.65	.51	.58	.44	.67	.54	.57	.50	.61	.60
	p(3)	.18	.26	.31	.36	.50	.52	.16	.37	.35	.31	0	.25	.49	.35	.44	.30	.30	.42	.36	.46	.26	.42	.35	.47	.36	.39
	N	222	126	119	119	34	27	41	38	33	16	6	2	40	48	58	37	31	46	40	40	54	37	44	37	40	50
	X^2																										
PEP	p(1)	.97	.96	.98	.95	.98	.92	.96	1.0	.98	1.0	1.0	1.0	1.0	.97	.98	.93	1.0	.98	.94	.99	1.0	.97	.99	1.0	.81	.94
	p(2)	.03	.04	.02	.05	.02	.08	.04	0	.02	0	0	0	0	.03	.02	.07	0	.02	.06	.01	0	.03	.01	0	.19	.06
	N	312	272	143	137	44	50	45	40	32	17	11	5	50	46	64	46	50	50	52	47	56	44	52	32	50	50
	X^2																										
PGI	p(0)	-	-	-	-	-	-	-	-	-	-	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	-
	p(1)	.99	.99	1.0	1.0	1.0	1.0	1.0	.98	.96	1.0	1.0	.90	.99	1.0	.98	.91	1.0	.97	1.0	1.0	1.0	1.0	.99	.99	1.0	1.0
	p(2)	.01	.01	0	0	0	0	0	.02	.04	0	0	.10	0	0	.02	.09	0	.03	0	0	0	0	.01	.01	0	0
	N	322	276	152	137	50	50	45	40	40	17	11	5	50	50	69	46	50	50	43	47	56	44	62	39	50	50
	X^2																										
AGP1		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
AGP2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
AGP3		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
EST2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
EST3		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
IDH		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
LAP2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
MDH1		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
MDH2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
TO		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

Table 4a. Genotype frequencies for individual trees at Flaming Gorge site.

		LPP (thick phloem)					LPP (thin phloem)					PP (thick phloem)				PP (thin phloem)		
Enzyme		1	2	3	4	[P]	5	6	7	8	[P]	26	29	30	[P]	21	24	[P]
AAT1	1-1	46	35	39	37	157	9	19	14	15	57	13	11	21	45	13	8	21
	1-2	40	43	44	43	170	14	24	18	13	69	15	9	26	50	10	11	21
	2-2	11	14	16	18	62	4	11	6	7	28	2	4	8	14	3	6	9
	[2-3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	97	92	99	98	389	27	54	38	35	154	30	24	55	109	26	25	51
	X^2	.3	.0	.4	.8	1.9	.2	.5	.0	1.6	.8	.2	.4	.0	.0	.1	.3	.8
AcP	0-0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0-1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	-	2
	0-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-1	50	33	47	36	167	13	27	19	13	72	14	13	23	50	19	13	32
	1-2	45	52	41	37	175	6	18	16	10	50	15	9	23	47	17	11	28
	2-2	12	7	11	20	48	3	9	3	4	19	2	2	3	7	8	4	12
	[1-3]	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-
	N	107	92	99	93	390	22	54	38	27	141	31	24	54	109	46	28	74
	X^2	.2	4.8*	.2	3.1	.1	.96	3.4	0	.4	4.3*	.3	0	.8	.8	1.4	.4	1.8
CK	1-1	90	62	68	69	289	14	59	29	34	136	4	10	34	48	51	30	81
	[1-2]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	90	62	68	69	289	14	59	29	34	136	4	10	34	48	51	30	81
EST1	1-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1-2	0	2	2	0	4	0	1	0	1	2	1	0	0	1	1	0	1
	1-3	1	0	0	1	2	0	1	0	0	1	0	1	0	1	0	0	0
	1-4	1	0	1	0	2	0	0	0	1	1	0	0	0	0	1	0	1
	1-5	0	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0
	1-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2-2	19	15	17	16	67	3	11	10	7	31	6	7	7	20	5	12	17
	2-3	20	14	16	24	73	4	13	7	2	26	4	1	10	15	13	10	23
	2-4	15	16	19	8	47	3	6	4	6	19	2	1	4	7	2	3	5
	2-5	21	24	17	22	86	3	8	5	11	27	8	7	8	23	10	9	19
	2-6	0	0	1	1	2	0	0	0	0	0	0	0	0	0	1	0	1
	3-3	9	10	7	6	32	2	1	3	1	7	1	0	7	8	8	4	12
	3-4	2	5	3	9	18	2	5	1	0	8	0	2	4	6	1	2	3
	3-5	11	10	9	12	42	5	7	3	6	21	2	1	2	5	11	6	17
	3-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4-4	3	4	3	2	12	0	0	1	0	1	1	1	3	5	0	0	0
	4-5	10	3	2	4	18	2	4	2	3	11	1	1	4	6	5	2	7
	4-6	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
	5-5	1	4	5	4	14	2	3	4	1	10	3	1	6	10	0	8	8
	5-6	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
	6-6	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
	N	113	98	102	110	420	26	61	40	39	166	31	23	57	110	60	56	116
	X^2	11.0	8.1	9.4	2.7	14.8	.8	3.3	2.0	3.5	3.4	.1	.7	9.9	11.1	5.7	4.7	3.8
LAP2	1-1	0	0	0	0	0	0	6	0	0	6	-	0	0	0	1	0	1
	1-2	2	1	4	2	9	0	4	2	2	8	-	2	1	3	3	0	3
	1-3	0	0	0	0	0	1	1	1	1	4	-	0	0	0	0	0	0
	2-2	35	42	26	44	147	6	16	13	20	55	-	3	2	5	19	18	37
	2-3	13	7	10	12	42	9	15	11	14	49	-	3	5	8	21	17	38
	3-3	2	0	2	3	7	5	6	5	2	18	-	0	0	0	7	10	17
	N	52	50	42	61	205	21	48	32	39	140	-	8	8	16	51	45	96
	X^2	0	0	.3	.8	3.7	2	7.5	.9	0	7.2	-	.2	1.6	2.0	.2	2.2	1.7
PEP	1-1	105	97	97	104	405	25	50	37	35	147	29	21	53	103	59	60	119
	1-2	9	1	3	4	17	2	2	2	3	9	1	3	5	9	0	0	0
	2-2	0	1	0	1	2	0	1	1	2	4	1	0	0	1	1	0	1
	N	114	101	100	109	424	27	53	40	40	160	31	24	58	113	60	60	120
	X^2	0	0	.2	.9	0	0	1.1	.9	2.0	2.6	0	0	.1	.3	0	0	0
PGI	[0-1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-1	113	99	101	109	422	27	63	39	40	169	31	24	58	113	60	60	120
	1-2	1	1	3	1	6	0	0	1	0	1	0	0	0	0	0	0	0
	2-2	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	N	114	100	105	110	429	27	63	40	40	170	31	24	58	113	60	60	120
	X^2	0	0	.3	0	.7	0	0	0	0	0	0	0	0	0	0	0	0
AGP1	N	114	100	106	100	420	27	61	38	40	176	31	24	53	108	44	32	76
AGP2	N	114	100	106	100	420	27	61	38	40	176	31	24	53	108	44	32	76
AGP3	N	114	100	106	100	420	27	61	38	40	176	31	24	53	108	44	32	76
EST2	N	114	99	106	109	428	26	61	40	39	166	30	23	56	109	60	56	116
EST3	N	114	99	106	109	428	26	61	40	39	166	30	23	56	109	60	56	116
IDH	N	88	72	96	110	366	27	63	40	40	170	31	24	50	105	49	32	81
LAP2	N	53	50	43	61	207	21	48	40	39	140	0	8	8	16	60	44	95
MDH1	N	114	100	100	110	424	27	61	40	40	168	31	24	50	105	52	30	82
MDH2	N	114	100	100	110	424	27	61	40	40	168	31	24	54	108	52	30	82
TO	N	114	100	99	100	411	27	61	38	40	166	31	24	53	107	44	32	76

Table 4b. Allele frequencies for beetles in individual trees at Flaming Gorge site.

		LPP (thick phloem)					LPP (thin phloem)					PP (thick phloem)				PP (thin phloem)		
Enzyme		1	2	3	4	[P]	5	6	7	8	[P]	26	29	30	[P]	21	24	[P]
AAT1	p(1)	.68	.61	.62	.60	.62	.59	.57	.61	.61	.59	.68	.65	.62	.64	.69	.54	.62
	p(2)	.32	.39	.38	.40	.38	.41	.43	.39	.39	.41	.32	.35	.38	.36	.41	.46	.38
	p(3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	97	92	99	98	389	27	54	38	35	154	30	24	55	109	26	25	51
AcP	p(0)	-	-	-	-	-	-	-	-	-	-	-	-	.01	0	.02	-	.01
	p(1)	.68	.64	.68	.59	.65	.73	.67	.71	.67	.69	.69	.73	.69	.70	.62	.66	.64
	p(2)	.32	.36	.32	.41	.35	.27	.33	.29	.33	.31	.31	.27	.28	.29	.36	.34	.35
	p(3)	-	-	-	-	-	-	-	-	-	-	-	-	.02	.01	-	-	-
	N	107	92	99	93	390	22	54	38	27	141	31	24	51	106	46	28	74
CK	p(1)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	p(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	90	62	68	69	289	14	59	29	34	136	4	10	34	48	51	30	81
EST1	p(1)	.01	.02	.01	0	.01	0	.02	0	.03	.01	.03	.02	0	.01	.02	0	.01
	p(2)	.42	.39	.44	.40	.41	.31	.41	.45	.44	.41	.45	.50	.32	.39	.31	.41	.36
	p(3)	.23	.25	.21	.26	.24	.29	.23	.21	.13	.21	.13	.11	.26	.20	.34	.23	.29
	p(4)	.15	.11	.15	.11	.13	.13	.12	.11	.13	.12	.08	.13	.17	.14	.08	.06	.07
	p(5)	.19	.23	.19	.22	.21	.27	.20	.23	.28	.24	.30	.24	.24	.25	.23	.29	.26
	p(6)	0	.01	0	0	0	0	.02	0	0	.01	0	0	.02	.01	.03	0	.01
	N	113	98	102	110	420	26	61	40	39	166	30	23	57	110	60	56	116
LAP2	p(1)	.02	.01	.05	.02	.02	.02	.18	.05	.04	.09	-	.13	.06	.09	.05	0	.03
	p(2)	.82	.92	.79	.84	.84	.50	.53	.61	.72	.60	-	.69	.63	.66	.61	.59	.60
	p(3)	.16	.07	.17	.15	.14	.48	.29	.34	.24	.32	-	.19	.31	.25	.34	.41	.38
	N	52	50	42	61	205	21	48	32	39	140	-	8	8	16	51	45	96
PEP	p(1)	.96	.99	.99	.97	.98	.96	.96	.95	.91	.95	.95	.94	.96	.95	.98	1.0	.99
	p(2)	.04	.01	.01	.03	.02	.04	.04	.05	.09	.05	.05	.06	.04	.05	.02	0	.01
	N	114	101	100	109	424	27	53	40	40	160	31	24	58	113	60	60	120
PGI	p(0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	p(1)	1.0	.99	.98	1.0	.99	1.0	.99	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	p(2)	0	.01	.02	0	.01	0	.01	0	0	0	0	0	0	0	0	0	0
	N	114	100	105	110	429	27	63	40	40	170	31	24	58	113	60	60	120
AGP1		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
AGP2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
AGP3		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
EST2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
EST3		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
[illegible]		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
LAP2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
MDH1		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
MDH2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
TO		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

Table 5a. Genotypes frequencies by host tree and site.

		Flaming Gorge			BR	SwT	McCall			LC	Yaak	Tar	Dub	Tet	Esc	HpL
Enzyme		LPP	PP	[P]	LPP	LPP	LPP	PP	[P]	LPP	LPP	LPP	LPP	LPP	PP	LPP
AAT1	1-1	214	66	280	35	9	17	6	23	17	18	30	30	23	43	28
	1-2	239	74	313	43	11	19	4	23	16	34	37	22	39	45	23
	2-2	110	23	133	8	9	9	4	13	5	17	13	10	13	12	9
	[2-3]	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
	N	443	163	726	87	29	45	14	59	38	69	80	62	75	100	60
	X^2	8.2**	.1	9.4**	1.0	1.7	.7	1.6	2.3	.1	0	.1	2.7	.3	0	1.3
AcP	0-0	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
	0-1	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-
	0-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-1	223	83	306	37	34	29	3	32	33	42	31	41	53	43	30
	1-2	248	76	324	15	32	20	11	31	24	27	25	30	22	33	30
	2-2	69	20	89	7	10	6	1	7	9	20	21	6	7	7	13
	[1-3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	540	180	720	59	76	55	15	70	66	89	79	77	82	83	73
	X^2	0	.2	.1	5.7*	.3	.8	2.5	0	1.7	11.1**	8.7	8.8**	0	3.8	0
CK	1-1	425	219	644	100	61	56	16	72	82	95	100	76	100	95	90
	[1-2]	-	-	-	-	1	1	-	1	-	1	-	-	-	-	-
	N	425	219	644	100	62	57	16	73	82	96	100	76	100	95	90
EST1	1-1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
	1-2	6	3	9	2	1	1	0	1	1	1	1	2	2	1	1
	1-3	3	1	4	1	0	2	0	2	0	0	2	0	0	0	1
	1-4	3	2	5	0	1	2	0	2	0	0	0	0	3	0	2
	1-5	1	0	1	0	1	0	0	0	1	1	1	2	1	1	1
	1-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2-2	98	48	146	10	11	11	4	15	9	22	13	11	6	0	23
	2-3	99	49	148	18	11	8	0	8	20	24	21	19	24	1	23
	2-4	66	24	90	4	11	9	3	12	5	9	7	3	0	1	2
	2-5	113	46	159	24	3	4	2	6	13	14	6	18	20	2	20
	2-6	2	1	3	0	0	1	0	1	1	10	2	0	0	0	0
	3-3	40	20	60	3	14	5	0	5	10	2	12	12	5	0	6
	3-4	26	11	37	2	8	6	0	6	4	11	6	3	1	7	0
	3-5	62	37	99	13	10	4	3	7	18	10	13	14	20	6	7
	3-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4-4	13	1	14	0	2	2	1	3	0	2	1	0	1	26	0
	4-5	29	18	47	14	5	0	0	0	8	3	0	9	13	31	2
	4-6	0	1	1	1	1	1	0	1	0	0	0	0	0	2	0
	5-5	24	18	42	2	2	0	3	3	9	4	11	4	3	8	7
	5-6	0	1	1	0	0	0	0	0	0	0	0	0	0	3	0
	6-6	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0
	N	586	282	868	94	81	56	16	72	100	113	96	97	99	89	97
	X^2	9.5	5.6	20.5	20.8	9.5	2.3	1.4	9.1	3.1	17.3	18.2	9.8	28.4**	.8	5.2
LAP2	1-1	6	7	13	1	5	0	0	0	0	1	3	1	0	0	0
	1-2	17	11	28	2	12	5	3	8	2	8	1	10	9	7	3
	1-3	4	4	8	0	0	0	0	0	0	0	2	1	2	2	0
	2-2	205	95	300	17	31	21	4	25	32	34	29	23	35	21	36
	2-3	91	86	177	20	21	13	1	14	35	31	28	25	33	38	34
	3-3	25	35	60	21	10	10	0	10	19	21	14	20	12	13	17
	N	348	238	586	61	79	49	8	57	88	95	77	80	91	81	90
	X^2	14.4**	9.9*	24.6*	5.6	10.7*	6.4	.1	9.3	2.5	11.6**	6.9	10.8*	2.9	2.0	2.8
PEP	1-1	552	266	818	84	81	48	16	64	93	103	99	93	98	83	83
	1-2	26	9	35	10	4	1	0	1	3	5	0	5	1	1	9
	2-2	6	5	11	0	0	0	0	0	0	2	1	1	1	0	8
	N	584	280	864	94	85	49	16	65	96	110	100	99	100	84	100
	X^2	1.9	3.3	4.7	.1	.1	[illegible]			.2	1.9	0	.9	2.2	0	3.5**
PGI	[0-1]	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
	1-1	590	288	878	100	84	54	15	69	99	104	97	90	100	99	100
	1-2	7	1	8	0	0	3	1	4	0	11	3	0	0	2	0
	2-2	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0
	N	598	289	887	100	85	57	16	73	99	115	100	90	100	101	100
AGP1	N	596	184	780	90	61	47	16	63	72	93	94	66	98	91	75
AGP2	N	596	184	780	90	61	47	16	63	72	93	94	66	98	91	75
AGP3	N	596	184	780	90	61	47	16	63	72	93	94	66	98	91	75
EST2	N	594	225	819	94	81	56	16	72	100	117	96	97	99	89	97
EST3	N	594	225	819	94	81	56	16	72	100	117	96	97	99	89	97
IDH	N	536	186	722	100	74	57	16	73	82	108	100	88	100	101	90
LAP1	N	347	111	458	61	79	49	8	57	88	106	77	92	91	81	90
MDH1	N	578	187	765	100	82	57	15	72	82	112	100	[illegible]	100	101	90
MDH2	N	578	190	768	100	79	57	13	70	82	112	100	.	100	101	90
TO	N	577	183	760	90	61	47	16	63	72	80	94	66	98	91	75

Table 5b. Allele frequencies for beetles by host tree and site.

		Flaming Gorge			BR	Swt	McCall			LC	Yaak	Tar	DuB	Tet	Esc	HpL
Enzyme		LPP	PP	[P]	LPP	LPP	LPP	PP	[P]	LPP	LPP	LPP	LPP	LPP	PP	LPP
AAT1	p(1)	.59	.63	.60	.65	.50	.59	.57	.58	.66	.51	.61	.66	.57	.66	.66
	p(2)	.41	.37	.40	.34	.50	.41	.43	.42	.34	.49	.39	.34	.43	.35	.34
	p(3)	-	-	-	.01	-	-	-	-	-	-	-	-	-	-	-
	N	443	163	726	87	29	45	14	59	38	69	80	62	75	100	60
AcP	p(0)	-	.01	-	-	-	-	-	-	-	-	.01	-	-	-	-
	p(1)	.64	.67	.65	.75	.66	.71	.57	.68	.68	.62	.56	.56	.73	.78	.72
	p(2)	.36	.32	.35	.25	.34	.39	.43	.32	.32	.38	.43	.44	.27	.22	.28
	p(3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	N	540	180	720	59	76	55	15	70	66	89	79	77	82	83	73
CK	p(1)	1.0	1.0	1.0	1.0	.99	.99	1.0	.99	1.0	.99	1.0	1.0	1.0	1.0	1.0
	p(2)	-	-	-	-	.01	.01	-	.01	-	.01	-	-	-	-	-
	N	425	219	644	100	62	57	16	73	82	96	100	76	100	95	90
EST1	p(1)	.01	.01	.01	.02	.02	.04	0	.03	.02	.01	.02	.02	.03	.01	.05
	p(2)	.41	.39	.40	.36	.30	.40	.41	.40	.29	.45	.33	.33	.29	.03	.47
	p(3)	.23	.24	.24	.21	.35	.27	.09	.23	.31	.22	.34	.31	.28	.08	.22
	p(4)	.13	.10	.12	.11	.19	.20	.16	.19	.09	.12	.08	.08	.10	.52	.03
	p(5)	.22	.24	.23	.29	.14	.07	.34	.13	.29	.16	.22	.26	.30	.33	.23
	p(6)	0	.01	.01	.01	.01	.02	0	.01	.01	.04	.01	0	0	.03	0
	N	586	282	868	94	81	56	16	72	100	113	96	97	99	89	97
LAP2	p(1)	.05	.06	.05	.03	.14	.05	.19	.07	.01	.05	.06	.08	.06	.06	.02
	p(2)	.74	.60	.69	.46	.60	.61	.75	.63	.57	.56	.56	.51	.62	.54	.61
	p(3)	.21	.34	.26	.51	.26	.34	.06	.30	.41	.39	.38	.41	.32	.41	.38
	N	348	238	586	61	79	49	8	57	88	95	77	80	91	81	90
PEP	p(1)	.97	.97	.97	.95	.98	.99	1.0	.99	.98	.96	.99	.96	.99	.99	.88
	p(2)	.03	.03	.03	.05	.02	.01	0	.01	.02	.04	.01	.04	.01	.01	.12
	N	584	280	864	94	85	49	16	65	96	110	100	99	100	84	100
PGI	p(0)	-	-	-	-	-	-	-	-	.01	-	-	-	-	-	-
	p(1)	.99	1.0	.99	1.0	.99	.97	.97	.97	.99	.95	.99	1.0	1.0	.99	1.0
	p(2)	.01	0	.01	0	.01	.03	.03	.03	0	.05	.01	0	0	.01	0
	N	598	289	887	100	85	57	16	73	100	115	100	90	100	101	100
AGP1		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
AGP2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
AGP3		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
EST2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
EST3		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
IDH		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
LAP2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
MDH1		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
MDH2		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
TO		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

Table 6. Contingency chi-square values for pairwise comparison of MPBs from LPP thick phloem, LPP thin phloem, PP thick phloem, and PP thin phloem.

		LPP: thick	LPP: thin	PP: thick	PP: thin
AAT1:	LPP thick	---			
	LPP thin	.7	---		
	PP thick	.3	1.2	---	
	PP thin	0	.2	.2	---
AcP:	LPP thick	---			
	LPP thin	1.2	---		
	PP thick	13.5**	4.3	---	
	PP thin	10.6**	4.7	4.0	---
EST1:	LPP thick	---			
	LPP thin	2.7	---		
	PP thick	5.5	.8	---	
	PP thin	14.7*	8.8	9.1	---
LAP2:	LPP thick	---			
	LPP thin	53.6**	---		
	PP thick	9.5**	.6	---	
	PP thin	45.1**	7.7*	4.9	---
PEP:	LPP thick	---			
	LPP thin	7.3**	---		
	PP thick	4.5*	0	---	
	PP thin	2.0	8.4**	7.0*	---

Table 7a. Allele frequencies for MPB samples representing different population phases.

		Endemic:		Epidemic:			Post-Epidemic:	
Enzyme		Sawtooth	Hoop Lake	Logan Canyon	Yaak	Dubois	Targhee	Teton
AAT1	p(1)	.50	.66	.66	.51	.66	.61	.57
	p(2)	.50	.34	.34	.49	.34	.39	.43
	p(3)	-	-	-	-	-	-	-
	N	29	60	38	69	62	80	75
AcP	p(0)	-	-	-	-	-	.01	-
	p(1)	.66	.72	.68	.62	.56	.56	.73
	p(2)	.34	.28	.32	.38	.44	.43	.27
	p(3)	-	-	-	-	-	-	-
	N	76	73	66	89	77	79	82
CK	p(1)	.99	1.0	1.0	.99	1.0	1.0	1.0
	p(2)	.01	-	-	.01	-	-	-
	N	62	90	82	96	76	100	100
EST1	p(1)	.02	.05	.02	.01	.02	.02	.03
	p(2)	.30	.47	.29	.45	.33	.33	.29
	p(3)	.35	.22	.31	.22	.31	.34	.28
	p(4)	.19	.03	.09	.12	.08	.08	.10
	p(5)	.14	.23	.29	.16	.26	.22	.30
	p(6)	.01	0	.01	.04	0	.01	0
	N	81	97	100	113	97	96	99
LAP2	p(1)	.14	.02	.01	.05	.08	.06	.06
	p(2)	.60	.61	.57	.56	.51	.56	.62
	p(3)	.26	.38	.41	.39	.41	.38	.32
	N	79	90	88	95	80	77	91
PEP	p(1)	.98	.88	.98	.96	.96	.99	.99
	p(2)	.02	.12	.02	.04	.04	.01	.01
	N	85	100	96	110	99	100	100
PGI	p(0)	-	-	.01	-	-	-	-
	p(1)	.99	1.0	.99	.95	1.0	.99	1.0
	p(2)	.01	0	0	.05	0	.01	0
	N	85	100	100	115	90	100	100
HETEROZYGOSITY		13.6%	13.1%	12.8%	14.1%	13.6%	13.4%	12.6%

Table 7b. Contingency chi-square values from pairwise comparison of MPB samples representing different population phases.

		Sawtooth	Hoop L.	Logan C.	Yaak	Dubois	Targhee	Teton
AAT1:	Sawtooth	---						
	Hoop L.	4.1*	---					
	Logan C.	3.4	0	---				
	Yaak	0	6.0*	4.5*	---			
	Dubois	4.3*	0	0	6.4*	---		
	Targhee	2.0	.8	.6	2.9	.9	---	
	Teton	.7	2.3	1.7	1.0	2.6	.5	---
AcP:	Sawtooth	---						
	Hoop L.	1.3	---					
	Logan C.	.2	.4	---				
	Yaak	.4	3.4	1.1	---			
	Dubois	2.8	8.0**	4.1	1.2	---		
	Targhee	4.7*	10.2**	5.8*	3.5	2.0	---	
	Teton	1.7	0	.7	4.0	8.9**	10.9**	---
EST1:	Sawtooth	---						
	Hoop L.	39.8**	---					
	Logan C.	16.2**	20.2**	---				
	Yaak	20.6**	27.2**	27.6**	---			
	Dubois	16.4**	14.1*	1.8	24.2**	---		
	Targhee	11.2*	18.1**	3.2	19.0**	3.1	---	
	Teton	18.5**	19.0**	1.9	30.1**	2.1	144.1**	---
LAP2:	Sawtooth	---						
	Hoop L.	20.7**	---					
	Logan C.	24.9**	.6	---				
	Yaak	11.4**	3.7	5.0	---			
	Dubois	9.3**	9.3**	9.9**	1.8	---		
	Targhee	8.7**	4.3	5.8	.1	1.3	---	
	Teton	6.6**	5.2	8.2*	1.5	4.1	1.0	---
PEP:	Sawtooth	---						
	Hoop L.	13.1**	---					
	Logan C.	.3	17.7**	---				
	Yaak	.9	10.0**	2.3	---			
	Dubois	.4	10.8**	1.5	.1	---		
	Targhee	1.1	21.0**	.2	3.9*	2.9	---	
	Teton	.4	18.6**	0	2.5	1.7	.2	---
PGI:	Sawtooth	---						
	Hoop L.	2.4	---					
	Logan C.	3.2	1.0	---				
	Yaak	4.0*	9.8**	10.9**	---			
	Dubois	2.1	0	.9	8.8**	---		
	Targhee	.1	3.0	4.0	3.7	2.7	---	
	Teton	2.4	0	1.0	9.8**	0	3.0	---

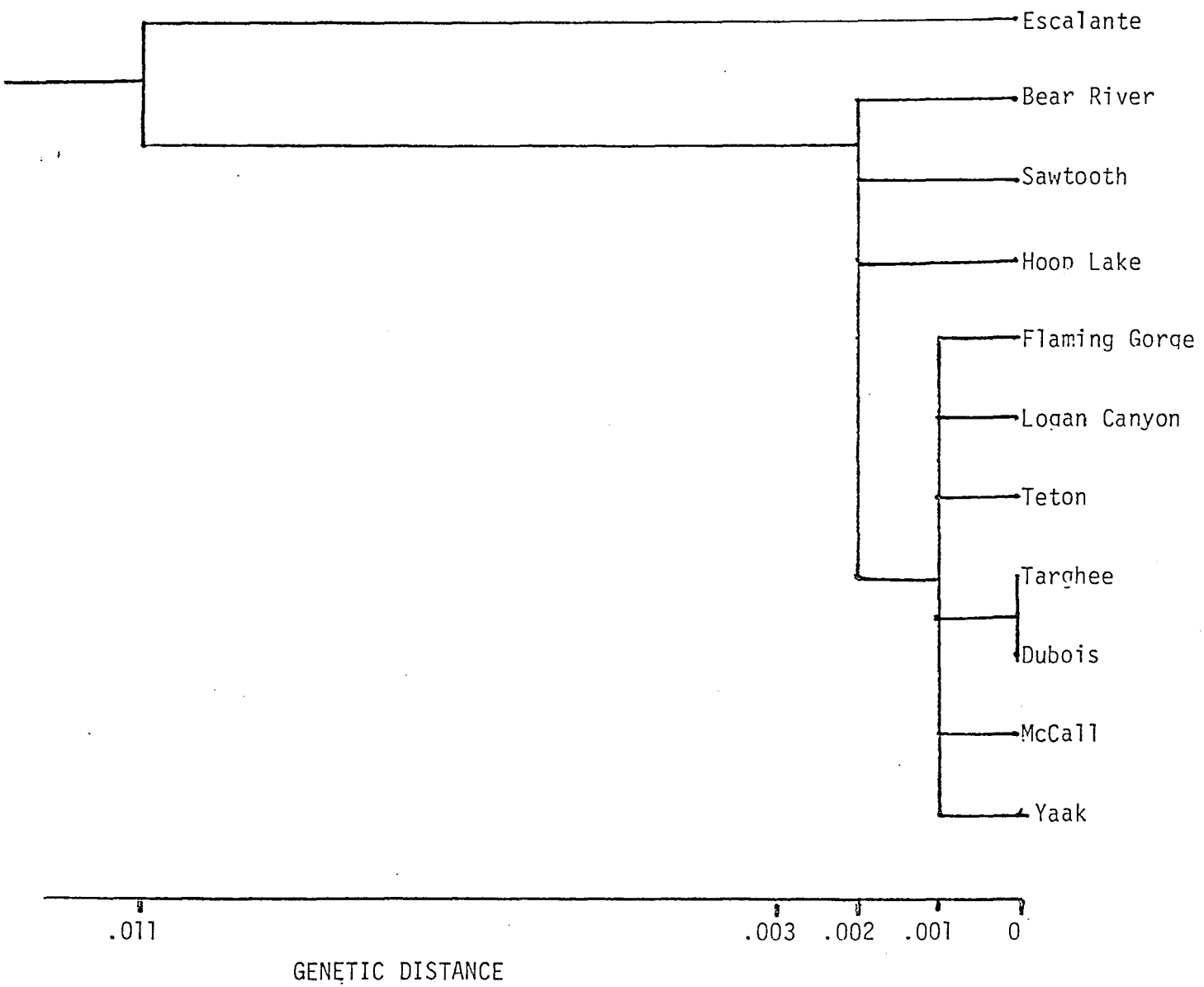


Figure 1. Genetic relationships among mountain pine beetle samples from 11 sites.